REMARKS

35 U.S.C. § 112, second paragraph

Claims 15-20 and 24 have been rejected under 35 U.S.C. § 112, second paragraph. Particularly, the Examiner contends that the terms "wettable aerogel/carbon composite" and "wettable xerogel/carbon composite" are not supported by the specification.

Applicants respectfully disagree. Applicants' composites are wettable, particularly for their ability to be soaked in a molten electrochemical fuel cell. See, *inter alia*, paragraphs [0006] and [0009] of the present application. As would be apparent to one skilled in the art reading the present disclosure, the wettability of Applicants' composites is what allows them to thrive in the molten electrolytes of the molten electrochemical fuel cell described in the present application.

Withdrawal of the rejection is respectfully requested.

Claims 15, 20

Claims 15 and 20 have been rejected under 35 U.S.C. § 102(b) as being anticipated by Petricevic et al. ("Planar fibre reinforced carbon aerogels and application in PEM fuel cells").

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). Moreover, the identical invention must be shown in as complete detail as contained in the claim. *Richardson v. Suzuki Motor Co.* 868 F.2d 1226, 1236, 9USPQ2d 1913, 1920 (Fed. Cir. 1989). The elements must be arranged as required by the claim. *In re Bond*, 910 F.2d 831, 15 USPQ2d 1566 (Fed. Cir. 1990).

Claim 15 was previously amended to require that said composite is suitable for use as an anode with the chars being fuel capable of being combusted in a molten salt electrochemical fuel cell in the range from 500 C to 800 C to produce electrical energy. In sharp contrast, nowhere does Petricevic teach or suggest that the disclosed structures are suitable for use as an anode

with the chars being fuel capable of being combusted in a molten salt electrochemical fuel cell in the range from 500 C to 800 C to produce electrical energy.

Further, neither the method of preparation of Applicant's monolith nor Applicant's final product is disclosed or suggested by the Petricevic reference. The Petricevic reference does not disclose or suggest preparing an anode with fuel. Applicant submits that the method of preparation of Applicant's monolith and fuel as well as the finished product is not disclosed or suggested in Petricevic. The anticipation rejection of claims 15 and 20 should be withdrawn.

Additionally, the rejection of claim 15 relies on inherency, and particularly that the pyrolizing step of Petricevic will produce wettable carbon chars meeting the claimed limitations. However, the fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic. *In re Rijckaert*, 9 F.3d 1531, 1534, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993); *In re Oelrich*, 666 F.2d 578, 581-82, 212 USPQ 323, 326 (CCPA 1981). Rather, to establish inherency, the extrinsic evidence 'must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.' *In re Robertson*, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999) (citations omitted). In relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art." *Ex parte Levy,* 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990) (emphasis in original).

Returning to the present office action, and particularly the "Response to Arguments" section, the Examiner contends that Petricevic's pyrolizing step inherently produces chars. The Examiner then goes on to state that Petricevic's product is capable of being used as an anode in a molten salt fuel cell based on the facts recited therein.

Applicants respectfully disagree with the Examiner's factual basis, and further assert that such basis is not only erroneous in several respects, but also prohibitively relies on probabilities

or possibilities. Again, inherency may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient. *In re Robertson, supra.*

The Examiner first argues that the claims do not require that the finished product be wettable. However, claim 15 clearly requires "pyrolyzing said composite gel to form a *wettable* aerogel/carbon composite or a *wettable* xerogel/carbon composite...." The composite is at least a part of the finished product.

The Examiner then attempts to refute use of Petricevic's US Patent No. 6,503,655 to exemplify the criticality of Petricevic's hydrophobicity. Particularly, the Examiner indicates that there is no evidence to show that the product in US6503655 is the same product as in Petricevic. In reply, Applicants note that the products in the two references are extremely similar. For instance, both references describe a porous carbon gas diffusion electrode. See Petricevic "Introduction, last paragraph; and US6503655, Abstract. Further, because both references were authored by Petricevic concurrently, it is reasonable to infer that the inventor (Petricevic) applied common principles when authoring both references.

Next, the Examiner states that there is no evidence to show that the product disclosed by Petricevic is entirely hydrophobic. Again, reference is made to the second paragraph of Petricevic's "Introduction" where he states that the product should be hydrophobic in order to allow for a sufficiently fast release of water.

Finally, the Examiner states that no evidence has been presented to show that his aerogel cannot be used as an anode with wettable chars being fuel capable of being combusted in a molten salt electrochemical fuel cell in the range from 500 C to 800 C to produce electrical energy. Applicants respectfully disagree. As set forth in more detail below, since Petricevic's preference for gas diffusion electrode composites entails open structure gas diffusion, such electrodes must be hydrophobized in order to avoid liquid accumulations in the pores, whereas Applicants' composites thrive on being wettable by molten electrolytes of the molten electrochemical fuel cell.

Further, Applicants again assert that the burden of providing evidence that Petricevic's disclosure meets the claims limitations is on the Examiner, not on Applicants. As exemplified

above, the only evidence proffered by the Examiner so far is impermissibly based on possibilities or probabilities. Regardless, Applicants have presented evidence, based on Petricevic's teachings, that show sharp distinctions between Petricevic and the claims.

Accordingly, the Examiner's reasoning is erroneous, and the rejection based on inherency must be withdrawn.

Therefore, Applicants again assert that no evidence has been provided the procedures disclosed in Petricevic would produce wettable chars that are fuel capable of being combusted in a molten salt electrochemical fuel cell in the range from 500 C to 800 C to produce electrical energy. In fact, the only support in the rejection is to section 3.2 of Petricevic, which indicates that the wettability of the RF sol depends on the hydrophilic character of the fleece. However, this appears to refer to a step prior to pyrolyization. Particularly, a sol is generally defined as a fluid colloidal system (solids suspended in a liquid); especially: one in which the continuous phase is a liquid. A full reading of Section 3.2 appears to support this reading. For instance, adding the immediately following sentence to the sentence cited in the rejection, we have:

> The wettability with the RF sol depends on the hydrophilic character of the fleece. Cellulose is very hydrophilic and thus shows good wettability which simplifies the handling during preparation. (emphasis added)

Thus, the section of Petricevic relied on to anticipate claim 15 in actuality refers to a different processing step.

As noted in Applicants' prior response filed April 5, 2007, not only is Applicants' method of preparation different, but the final product is also different. It is the method of preparation that defines the properties of the final product. Accordingly, because the final products are different, the method to produce them must also be different. It follows that Petricevic cannot then inherently disclose the claimed product by process because the two different products inherently must be created using different steps and compositions.

As evidence that Petricevic fails to inherently contain pyrolyzing said composite gel to form a wettable aerogel/carbon composite or a wettable xerogel/carbon composite, reference is made to Petricevic Section 1, second paragraph, where he states that "The oxygen electrode should be hydrophobic in order to allow for a sufficiently fast release of water."

The Petricevic product and the monolith of claim 15 are used in two very different applications. Petricevic designed his material to be used as gas diffusion electrodes in batteries and especially in PEM fuel cells. The monolith of claim 15, on the other hand is meant to be suitable as an anode as well as a source of fuel for Direct Carbon Fuel Cells (DCFC). Clearly, these are very different applications. Further, the vast difference in their uses gives rise to significant differences in these products as well.

The most obvious difference between the two products is hydrophobicity. Specifically, in order to properly function as a gas diffusion electrode the Petricevic material must be hydrophobic. The monolith of claim 15 allows the DCFC electrolyte to be in intimate contact with the anode so that the anode material can be consumed as a fuel. Thus making the monolith of claim 15 hydrophobic will work against its intended use. So what is good for Petricevic (i.e., hydrophobicity) is bad for the monolith of claim 15.

It should be noted that this difference in properties is not a trivial matter. For while most of the starting materials used to make both products are quite similar the processes and compounds needed to make Petricevic hydrophobic are entirely different from anything found in claim 15.

Further, U.S. Patent No. 6,503,655 to Petricevic et al. (hereinafter, the '655 Patent, already of record) describes in detail the complexity of the process required to impart this critical property (hydrophobicity). This is clearly described in Examples 1 & 2 of the '655 Patent which indicate that it is necessary to impregnate the product with compounds such as trimethylchlorosilane (Example 1) or a copolymer of 2, 2-dimethyldioxole and tetrafluoroethylene in perfuorodecane (Example2) in order to impart the desired degree of hydrophobicity. Furthermore, the Patent makes clear that these procedures are necessary to give the material its required hydrophobic property. Nothing like this is required by claim 15.

To further stress the critical nature of all this, Petricevic explicitly mentions in Claim 1

(the independent claim) of the '655 Patent that the "composite" material has to be hydophobicized. Its importance is further underlined by Claims 18, 19, 20 & 21 of the '655 Patent.

Given this difference between Petricevic and claim 15 we believe there is no reason for claim 15 to be rejected.

Therefore, absent a reasonable showing of how Petricevic inherently contains the missing claim limitations, not based on probabilities or possibilities, the rejection must be withdrawn.

For any of the foregoing reasons, reconsideration and allowance of claim 15 is respectfully requested.

Claim 20 depends from claim 15, and therefore incorporate the limitations of claim 15. By virtue of its dependence, claim 20 is also believed to be allowable.

Further, claim 20 is directed to a xerogel/carbon composite, not an aerogel. Accordingly, Petricevic has been misapplied.

In the rejection, the Examiner indicates that claim 20 has not been given patentable weight because claim 15 is interpreted as forming an aerogel/carbon composite. This is error. Claim 15 clearly applies to aerogels or xerogels. Note the first limitation in claim 15: "...providing a solution of organic aerogel or xerogel precursors...." Note also the pyrolizing limitation of claim 15: "...pyrolyzing said composite gel to form a wettable aerogel/carbon composite or a wettable xerogel/carbon composite...."

Additionally, the doctrine of claim differentiation supports the Applicants' position. The doctrine of claim differentiation creates a presumption that each claim in a patent has a different scope. The difference in meaning and scope between claims is presumed to be significant to the extent that the absence of such difference in meaning and scope would make a claim superfluous. Accordingly, by affirmatively claiming a xerogel in claim 20, claim is limited to xerogels, which are not shown in Petricevic.

Still further, regarding claim 20, Applicants respectfully assert that any obviousness-type rejection based on Petricevic would be erroneous for failing to provide evidence that Petricevic's

aerogel inherently has a porosity that prevents percolation through its interior. Rather, Petricevic is replete with discussion of the high degree of porosity his structures contain.

Claims 1, 3, 5, 14, 24

Claims 1, 3, 5, 14 and 24 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Petricevic in view of Gartside et al. (US5866745).

Applicants first assert that Gartside is nonanalogous art. One of the first inquiries in an obviousness analysis is whether all of the references relied on are analogous art. "In order to rely on a reference as a basis for rejection of an applicant's invention, the reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the inventor was concerned." *In re Oetiker*, 977 F.2d 1443, 1446, 24 USPQ2d 1443, 1445 (Fed. Cir. 1992).

Gartside is directed to a method for producing olefins (hydrocarbons) from a hydrocarbon feedstock by a steam pyrolysis reaction in the presence of small quantities of essentially pure oxygen. *See* Gartside Abstract. This is certainly outside the field of applicant's endeavor, that of creating composites comprising carbon chars, said chars being fuel capable of being combusted in a molten salt electrochemical fuel cell in the range from 500 C to 800 C to produce electrical energy. As noted by the Examiner in the "Response to Arguments" section, the pertinent pyrolizing in the present case is performed in a non-oxidizing atmosphere. See also paragraph [0007] of the present application.

Nor can it be said that Gartside is reasonably pertinent to the particular problem with which the inventors were concerned, namely creating a composite material comprising chars. Not only does Gartside not disclose aerogels or xerogels, his steam pyrolysis is performed in an oxidizing atmosphere, which results in formation of olefinic hydrocarbons. Such hydrocarbons may not be fuel capable of being combusted in a molten salt electrochemical fuel cell in the range from 500 C to 800 C to produce electrical energy. Accordingly, the rejection of claims 1, 3, 5, 14 and 24 violates the rule of *In re Oetiker*, *supra*, and must be withdrawn.

The analysis of obviousness was set forth in *Graham v. John Deere*, 383 U.S. 1, 148

USPQ 459 (1966). In order to establish a *prima facie* case of obviousness, three basic criteria must be met:

> First, there must be some *suggestion or motivation*, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine the teachings of the references. Second, there must be a *reasonable expectation of success*. Finally, the prior art reference or combined references must teach or suggest *all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art*, and not based on applicant's disclosure (*In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991; *emphasis added*).

Applicants respectfully traverse the rejection as failing the *Graham* test. Specifically, the combination proposed in the rejection fails at least the first and third elements of the *Graham* test.

Regarding the third element of the *Graham* test, to establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). "All words in a claim must be considered in judging the patentability of that claim against the prior art." *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970).

Claim 1 was previously amended to require that the chars are fuel capable of being combusted in a molten salt electrochemical fuel cell in the range from 500 C to 800 C. In sharp contrast, neither the method of preparation of Applicant's monolith nor Applicant's final product is disclosed or suggested by the Petricevic reference. The Petricevic reference does not disclose or suggest preparing a fuel. Applicant submits that the method of preparation of Applicant's monolith and fuel as well as the finished product is not disclosed or suggested in Petricevic.

Nor does the addition of the teachings of Gartside save the rejection, as Gartside discloses an entirely unrelated process and product.

Accordingly, the rejection fails the third prong of the *Graham* test. The obviousness rejection should be withdrawn.

The rejection also fails the first prong of the *Graham* test.

The claimed invention have not have been predictable from the bare teachings of the prior art itself, or in knowledge generally known to those skilled in the art. The United States Supreme Court has acknowledged that there is no obviousness where the end result is unpredictable. In the recent case, *KSR International v. Teleflex Inc.*, 550 U.S. __ (2007), the Court's analysis included by implication the traditional notion that evidence of unpredictable results is evidence of non-obviousness. Therefore, even though the Court made sweeping changes to the obviousness analysis, it acknowledged that a showing of unpredictable results could defeat an assertion of obviousness.

The courts have repeatedly stated that the chemical arts are, by their very nature, unpredictable. This case is no different. There has been no showing that Gartside's catalysts would work as suggested by the Examiner. Even the Examiner must concede that the result of using Gartside's catalysts with Petricevic's process is unpredictable.

Further, Gartside does not disclose aerogels or xerogels, but a different process altogether for creating olefinic hydrocarbons. Particularly, his steam pyrolysis is performed in an oxidizing atmosphere, which results in formation of olefinic hydrocarbons. *See* Gartside Abstract. Whether Gartside's catalysts would work with Petricevic's process to create composites comprising chars that are fuel capable of being combusted in a molten salt electrochemical fuel cell in the range from 500 C to 800 C to produce electrical energy is unpredictable.

Claims 3, 5 and 14 depend from claim 1, and therefore incorporate the limitations of claim 1. By virtue of their dependence, claims 3, 5 and 14 are also believed to be allowable.

Further, regarding claim 14, as previously amended, Petricevic fails to disclose performing pyrolysis in the presence of any of the listed materials. *See* Petricevic "Experimental," indicating that the pyrolysis is performed in the presence of Ar gas.

Claims 2, 12

Claims 2 and 12 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Petricevic in view of Gartside and in yet further view of Erkey et al. (US20040029982).

The rejection of claim 2 applies Petricevic and Gartside as for claim 1. Claim 2 depends from claim 1, and therefore the rejection suffers from the same deficiencies as set forth above with respect to claim 1. Because Erkey has merely been added to allegedly show the limitation of the dependent claim, claim 2 is believed to be allowable over the combination proposed by the Examiner. Reconsideration and allowance of claim 2 is respectfully requested.

The rejection of claim 12 applies Petricevic and Gartside as for claim 1. Claim 12 depends from claim 1, and therefore the rejection suffers from the same deficiencies as set forth above with respect to claim 1. Because Erkey has merely been added to allegedly show the limitation of the dependent claim, claim 12 is believed to be allowable over the combination proposed by the Examiner. Reconsideration and allowance of claim 12 is respectfully requested.

Claim 4

Claim 4 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over Petricevic in view of Gartside and in yet further view of Stepanian et al. (US20020094426).

The rejection of claim 4 applies Petricevic and Gartside as for claim 1. Claim 4 depends from claim 1, and therefore the rejection suffers from the same deficiencies as set forth above with respect to claim 1. Because Stepanian has merely been added to allegedly show the limitation of the dependent claim, claim 4 is believed to be allowable over the combination proposed by the Examiner. Reconsideration and allowance of claim 4 is respectfully requested.

Claim 13

Claim 13 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over Petricevic in view of Gartside and in yet further view of Rhine et al. (US20040132845).

The rejection of claim 13 applies Petricevic and Gartside as for claim 1. Claim 13 depends from claim 1, and therefore the rejection suffers from the same deficiencies as set forth above with respect to claim 1. Because Erkey has merely been added to allegedly show the limitation of the dependent claim, claim 13 is believed to be allowable over the combination proposed by the Examiner. Reconsideration and allowance of claim 13 is respectfully requested.

Claims 16-18, 21-23

Claims 16-18 and 21-23 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Petricevic in view of Erkey.

The rejection of claim 16 applies Petricevic as for claim 15. Claim 16 depends from claim 15, and therefore the rejection suffers from the same deficiencies as set forth above with respect to claim 15. Because Erkey has merely been added to allegedly show the limitation of the dependent claim, claim 16 is believed to be allowable over the combination proposed by the Examiner. Reconsideration and allowance of claim 16 is respectfully requested.

The rejection of claim 17 applies Petricevic as for claim 15. Claim 17 depends from claim 15, and therefore the rejection suffers from the same deficiencies as set forth above with respect to claim 15. Because Erkey has merely been added to allegedly show the limitation of the dependent claim, claim 17 is believed to be allowable over the combination proposed by the Examiner. Reconsideration and allowance of claim 17 is respectfully requested.

The rejection of claim 18 applies Petricevic as for claim 15. Claim 18 depends from claim 15, and therefore the rejection suffers from the same deficiencies as set forth above with respect to claim 15. Because Erkey has merely been added to allegedly show the limitation of the dependent claim, claim 18 is believed to be allowable over the combination proposed by the Examiner. Reconsideration and allowance of claim 18 is respectfully requested.

The rejection of claim 21 applies Petricevic as for claim 15. Claim 21 depends from claim

15, and therefore the rejection suffers from the same deficiencies as set forth above with respect to claim 15. Because Erkey has merely been added to allegedly show the limitation of the dependent claim, claim 21 is believed to be allowable over the combination proposed by the Examiner. Reconsideration and allowance of claim 18 is respectfully requested.

Regarding claims 22 and 23, the rejection applies Petricevic as for claim 15, and therefore is deficient for similar reasons as set forth above with respect to claim 15.

Claim 19

Claim 19 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over Petricevic in view of Gartside and in yet further view of Rhine et al. (US20040132845).

The rejection of claim 19 applies Petricevic as for claim 15. Claim 19 depends from claim 15, and therefore the rejection suffers from the same deficiencies as set forth above with respect to claim 15. Because Erkey has merely been added to allegedly show the limitation of the dependent claim, claim 19 is believed to be allowable over the combination proposed by the Examiner. Reconsideration and allowance of claim 19 is respectfully requested.

Conclusion

In the event that the Examiner finds any remaining impediment to the prompt allowance of these claims that could be clarified with a telephone conference, he or she is respectfully requested to initiate the same with the undersigned at 408-971-2573.

Respectfully submitted,

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